

A Systematic Study on the Ascidians in Korea

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韓國産 海鞘類의 分類學的 研究

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적 요

한국산 해초류의 분류학적 연구를 위해 1969년 7월부터 1989년 9월까지 남한의 삼면연안과 도서지방의 41개 지역에서 채집된 재료들을 동정, 분류한 결과 모두 2목 3아목 8과 40종으로 밝혀졌다. 이들 중 4종 (*Polyclinum planum*, *Didemnum candidum*, *Styela plicata*, *Molgula calvata*)은 한국미기록종이었다. 한국미기록종에 대해서는 기재와 그림을 작성하였으며, 또한 우리나라에서는 처음으로 골편과 양수관 방어기관에 특징이 있는 종에 대해서는 SEM사진을 첨부하여 특기하였다.

Key words: Systematics, Ascidians, Korea.

INTRODUCTION

With regard to the systematic study of Korean ascidians, the first recorded species, *Styela clava* from Incheon Bay, was reported by Kamita and Sato (1941). After that, Rho (1966, 1967, 1968, 1970, 1971, 1975), Rho and Huh (1984), and Rho and Lee (1989) reported 73 species in a series of reports.

The materials identified were collected from the rocks, piers, seaweeds, and other objects in the intertidal and subtidal zones by skin and SCUBA diving, and fishing nets. Specimens were collected from 41

localities from July 1969 to September 1989 (fig. 1). They were preserved in about 5% neutral formalin or 95% alcohol after narcotization with menthol. To observe the internal structures of the animals, they should be kept in the solution which was composed of 1% chromic acid and 50% acetic acid in the ratio 1:10 for a day, and then they were replaced into the solution of 1% chromic acid for a few hours before dissecting. The halves dissected were observed in detail under the binocular dissecting microscope.

For the purpose of observing the spicules and the siphonal armatures, they were gold-coated with ion

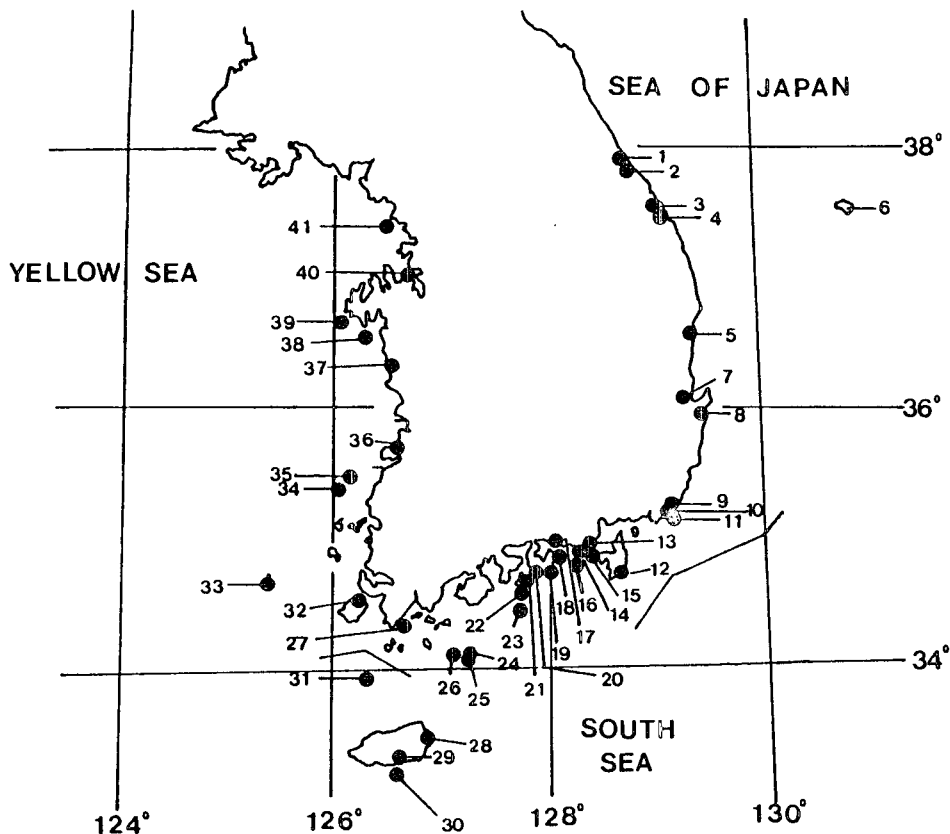


Fig. 1. A map showing the localities where the materials were collected from 1969 to 1989.

- 1, 주문진(注文津, Chumunjin); 2, 소돌(Sodol); 3, 근덕(近德, Kündök); 4, 덕산(德山, Töksan); 5, 대진(大津, Taejin); 6, 도동(道洞, To-dong); 7, 포항(浦港, P'ohang); 8, 구룡포(九龍浦, Kuryongp'o); 9, 미포(尾浦, Mip'o); 10, 부산(釜山, Pusan); 11, 동백섬(棟栢島, Tongbaekto); 12, 윤돌섬(輪芑島, Yundoldo); 13, 지세포(知世浦, Chisep'o); 14, 충무(忠武, Chungmu); 15, 호도(虎島, Hodo); 16, 비진도(比珍島, Pijindo); 17, 삼천포(三千浦, Samchönp'o); 18, 신수도(新樹島, Shinsudo); 19, 미조리(彌助里, Mijori); 20, 상주(尙州, Sangju); 21, 오동도(梧桐島, Odongdo); 22, 돌산도(突山島, Tolsando); 23, 금오도(金鰲島, Kūmodo); 24, 거문도(巨文島, Kōmundo); 25, 내장도(內障島, Naejang-do); 26, 서도(西島, Sōdo); 27, 완도(莞島, Wando); 28, 성산포(城山浦, Sōngsanp'o); 29, 서귀포(西歸浦, Sōgwip'o); 30, 문섬(蚊島, Munsōm); 31, 추자도(楸子島, Ch'ujado); 32, 여미(Yōmi); 33, 흑산도(黑山島, Hūksando); 34, 안마도(鞍馬島, Anmado); 35, 석만도(石萬島, Sōkmando); 36, 변산(邊山, Pyōnsan); 37, 대천(大川, Taech'ōn); 38, 삽시도(插矢島, Sapsido); 39, 신진도(新津島, Sinjindo); 40, 내도(內島, Naedo); 41, 작약도(芍藥島, Chakyakto).

sputter (JFC-1100) at 1.0 KV, 50mA for 10 minutes, and photographed with JSM 35CF-type scanning electron microscope.

The system of classification is based upon Tokioka (1953, 1960) and Kott (1985). All materials examined are deposited in the Department of Biology, Ewha Womans University, Seoul, Korea.

SYSTEMATIC ACCOUNT

Class Ascidiacea 해초 강

Order 1. Enterogona Perrier, 1989 내성해초 목

Suborder 1. Aplousobranchiata Lahille, 1886 무관 아목

Family 1. Policlinidae Verrill, 1871 만두멍게 과

Genus 1. *Amaroucium* Milne Edwards, 1841 만두멍게 속

1. *Amaroucium pliciferum* Redikorzev, 1927 만두멍게

Material examined: Yundoldo, Jul. 19, 1989 (J.I. Song); Sapsido, Jul. 21, 1989 (J.W. Lee).

2. *Amaroucium multiplicatum* (Sluiter, 1909) 주름만두멍게

Material examined: Kōmundo, Jul 29, 1988 (J.E. Lee).

3. *Amaroucium bermudae* Van Name, 1902 버뮤다만두멍게

Material examined: Pijindo, Jul. 19, 1973 (B.J. Rho).

Genus 2. *Polyclinum* Savigny, 1816 회색만두멍게 속

4. **Polyclinum planum* (Ritter and Forsyth, 1917) 배회만두멍게 (신칭)

(Fig. 2)

Glossophorum planum Ritter and Forsyth, 1917 (p.479, pl.39, fig. 13, pl.46, fig. 71).

Polyclinum planum Van Name, 1945 (pp.71-73, fig. 29).

Material examined: Mip'o, Jan. 28, 1988 (J.I. Song)

Description: Flattened colonies pumpkin-seed shaped, oval spherical, all having short, thick, cylindrical peducles, attached to rocks and free from sand. Colonies 7-10cm in length, 5-10cm in width, 1-2cm in thickness and grayish brown in life and dark violet or brown in preserved specimen. Zooids arranged irregularly, seen through test, and matrix transparent containig a great number of very small pigmented cells. In length, zooids 5-6mm, thorax 3-3.5mm and postabdomen slightly longer than abdomen. Tentacles 20-26, alternately arranged by long and short ones. Stigmatal rows 14-16, and 13-15 stigmata in a row. Narrow esophagus begins at dorsal corner of branchial sac, opens into a smooth-walled stomach which in turn connected with intestine at base of loop. Middle part of intestine plumped and connected with wide part of rectum. Rectum extends about half-way up to branchial sac at level of 7-8 transverse vessel and ends in a four to six-lobed aperture. Postabdomen is connected with abdomen by a long and attenuated stalk. It contains gonads and heart, Testis consists of 18-22 round follicles in middle part of postabdomen. The mass is indented at its inner and dorsal side by ovary, with eggs at various growth stages. Branchial aperture seen on surface of colony, with six lobed when fully expended, Atrial aperture overarched by a long broad languet.

Larva elliptical, 750-800 μ in length, 400-420 μ in width, with three adhesive organs, three anterior am-

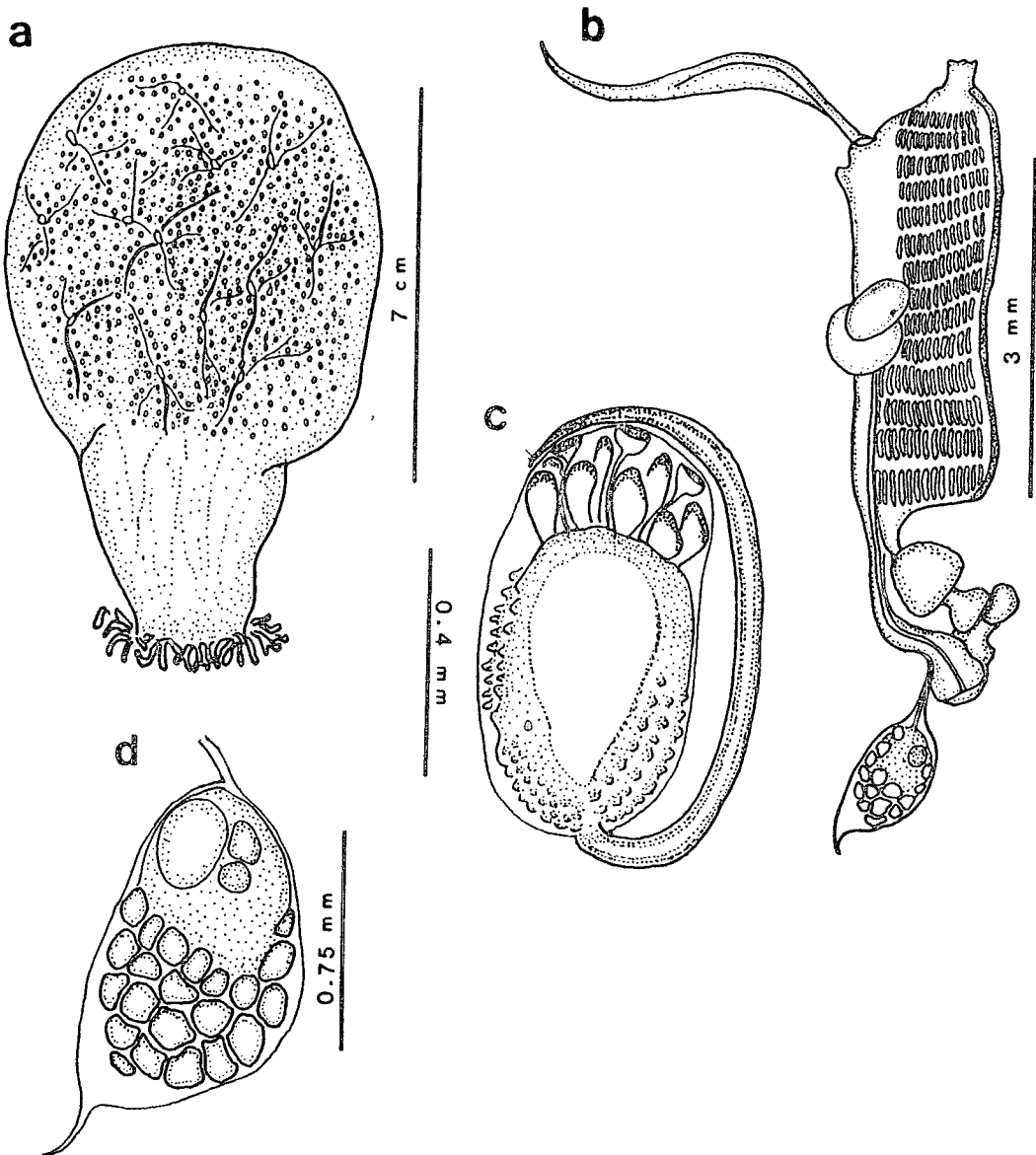


Fig. 2. *Polyclinum planum* (Ritter and Forsyth, 1927). a, Colony; b, Thorax and abdomen of zooid, right side; c, Larva from right side; d, Postabdomen of zooid.

pullae and lateral series of ampullary vesicles.

Remarks: The present specimens conform well to the type specimen (Van Name, 1945) in the internal structure. But they are distinguished by the arrangement of zooids.

Distribution: Korea (South Sea); America (California coast, Mendocino-San Diego)

Family 2. Didemnidae Verrill, 1871 흰덩이멍게 과

Genus 3. *Didemnum* Savigny, 1816 흰덩이멍게 속

5. *Didemnum (Didemnum) moseleyi* (Herdman, 1886) 흰덩이멍게

Material examined: Yundoldo, Jul. 19, 1989 (J.I. Song).

6. **Didemnum (Didemnum) candidum* Savigny, 1816 반짝흰덩이멍게 (신칭) (Fig. 3, Pl. 1a)

Didemnum annecteus: Van Name, 1921 (p.484).

Didemnum condidum: Michaelsen, 1919 (p.18); Monniot and Monniot, 1967 (p.4); Plough and Jones, 1937 (p.100); Van Name, 1945 (pp. 83-86, pl. 13, fig. 4. text-fig. 35); Tokioka, 1953a (pp. 246-247); 1955b (pp. 45-47, pl. 2, figs. 10-17, text-fig. 1.): 1970 (pp. 79-80, fig. 1); 1972 (pp. 386-387, fig. 2).

Didemnum cineraceum: Van Name, 1921 (p. 434)

Didemnum conchyliatum: Van Name, 1921 (p. 484)

Leptoclinum annectans: Herdman, 1886 (p. 280, pl. 34. fig. 14, pl. 38, figs. 5-9).

Leptoclinum conchyliatum: Sluiter, 1898 (p. 29, pl. 3, fig. 47).

Leptoclinum speciosum + *speciosum* var. *asperum*: Herdman, 1886 (PP. 274, 277, pl. 34, figs. 8-13, pl. 36, figs. 1-9).

Leptoclinum speciosum + vars. *bermudense*, *pageti*, *Hamiltoni*, *harringtonese*, *acutilobatum* and *somersi*: Van Name, 1902 (p.363, pl. 52, figs. 37, 42-52, pl. 61. fig. 127, pl. 62, figs. 130c, 132, 134-136)

Leptoclinum tenue: Sluiter, 1898 (p. 31).

Material examined: Yundoldo, Jul. 19, 1989 (J.I. Song).

Description: Colonies incrusting type with papillae, 150×120×10mm in size, attached on hard bottom. Surface even, common cloacal apertures not numerous, oval in outline situated at the top of each papillae. In color, zooids usually yellowish, colonies bright red in life, but pale gray in alcohol. Zooids usually yellowish, arranged in one layer of colony. Branchial apertures distinctly 6-lobed, conspicuous in preserved condition and atrial apertures widely opened. Calcareous spicules evenly scattered in the whole colonies but especially numerous in upper parts of them. Diameter of spicules 8-25µm, usually 20µm and intervals of them about 2.5-30µm. Rays numerous, short, blunt tips and 8-14 in number on equatorial plane. Zooids measure 1.2-1.7mm in total length, including 800-950µm in length of abdomen, and arranged at intervals of 180-300µm. Adult zooids have 6-7 tentacles, stigmata in four rows, and 7-8 stigmata per each row. Testicular follicle small, 1-2 in number, proximal part of sperm duct coiled 5-7 times, and one large ovary situated in anterior part of sperm duct. Anus opens on the level of 3rd transverse vessel. Larva not observed.

Remarks: The present specimen conforms to *Didemnum pardum* (Tokioka, 1962b) in abdomen of zooids and shapes of spicules, but differs from the size of spicules (31-37µm) and the number of tentacles (13-14). The interval of spicules are 2.5-30µm compared with 12-50µm of *Didemnum moseleyi*, and also the interval of zooids are 180-300µm shorter than 200-350µm of it.

Distribution: Korea (South Sea); Japan; Philippines; America (New Hampshire-Brazil); Red Sea-Malay region; Mediterranean; Atlantic coast of Europe; Northern Africa.

Genus 4. *Leptoclinides* Bjerkan, 1905 얼룩무늬멍게 속

7. *Leptoclinides madara* Tokioka 1953 얼룩무늬멍게 (Pl. 1c-d)

Material examined: Kōmundo, Jul. 29, 1988 (J.E. Lee).

Genus 5. *Trididemnum* Della Valle, 1881 세줄흰덩이멍게 속

8. *Trididemnum savignii* (Herdman, 1886) 세줄흰덩이멍게 (Pl. 1b)

Material examined: Sōdo, Jul. 29, 1988 (J.E. Lee)

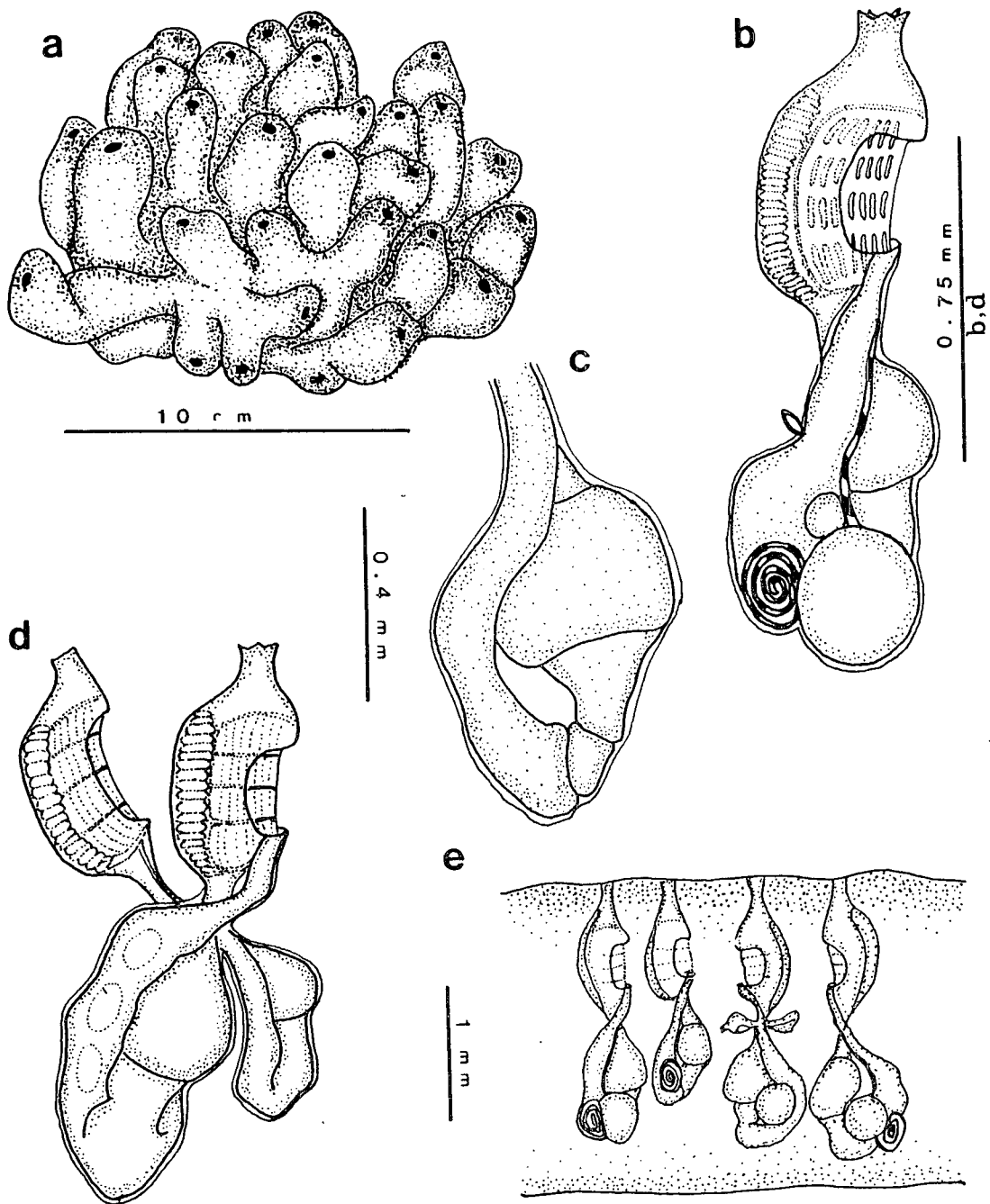


Fig. 3. *Didemnum candidum* Savigny, 1816. a, Colony; b, Zooid from left side; c, Abdomen of the zooid; d, Zooid with bud; e, Optical section of the colony.

Genus 6. *Diplosoma* Macdonald, 1859 이종명계 속

9. *Diplosoma maodonaldi* Herdman, 1886 맥도날드이종명계

Material examined: Mip'o, Jun. 5, 1983 (S. Shin); Kuryongp'o, Jul. 22, 1986 (J.I. Song).

Suborder 2. Phlebobranchiata Lahille, 1886 편새 아목

Family 3. Cionidae Lahille, 1887 유령멍게 과

Genus 7. *Ciona* Fleming, 1822 유령멍게 속

10. *Ciona intestinalis* (Linnaeus, 1767) 유령멍게

Material examined: Kuryongp'o, Jul. 22, 1986 (J.I. Song); Chungmu, Oct. 8, 1986 (KAIST).

Family 4. Rhodosomatidae Hartmeyer, 1908 안장멍게 과

Genus 8. *Chelyosoma* Broderip S. Sowerby, 1930 거북등안장멍게 속

11. *Chelyosoma dofleini* Hartmeyer, 1906 거북등안장멍게

Material examined: Shinsudo, Jul. 21, 1984 (B.J. Rho); Samchŏnp'o, Jul. 23, 1984 (B.J. Rho); Samchŏnp'o, Dec. 27, 1986 (J.I. Song); Toksan, Aug. 14, 1987 (B.J. Rho and J.W. Lee); Taejin, Jun. 19, 1988 (J.E. Lee).

Order 2. Pleurogona Perries, 1898 측성해초 목

Suborder 3. Stolidobranchiata Lahille, 1886 강새 아목

Family 5. Botryllidae Verrill, 1871 판멍게 과

Genus 9. *Botryllus* Gaertner, 1774 판멍게 속

12. *Botryllus tuberatus* Ritter and Forsyth, 1917 국화판멍게

Material examined: Odongdo, Jul. 20, 1977 (J.I. Song); P'ohang, Oct. 27, 1985 (S.J. Youn); Sinjindo, Jul. 10, 1989 (J.W. Lee); Yundoldo, Jul. 19, 1989 (J.I. Song); Pyŏnsan, Jul. 22, 1989 (J.E. Seo).

13. *Botryllus primigenus* Oka, 1928 제일판멍게

Material examined: Kōmundo, Jul. 27, 1988 (J.E. Lee).

14. *Botryllus magnicoecus* (Hartmeyer, 1912) 붉은판멍게

Material examined: Ch'ujado, Jul. 7, 1969 (B.J. Rho); P'ohang, Oct. 27, 1985 (S.J. Youn); Komundo, Jul. 27, 1988 (J.E. Lee).

15. *Botryllus schlosseri* (Pallas, 1766) 스칼로세르판멍게

Material examined: Kōmundo, Jul. 27, 1988 (B.J. Rho and J.E. Lee).

Genus 10. *Botrylloides* Milne Edwards, 1841 주머니판멍게 속

16. *Botrylloides violaceus* Oka, 1927 보라판멍게

Material examined: Sanju, Jul. 29, 1980 (J.I. Song); Sŏngsanp'o, Feb. 14, 1976 (B.J. Rho); Naejangdo, Jul. 24, 1988 (J.E. Lee).

Family 6. Styelidae Sluiter, 1895 미더덕 과

Genus 11. *Symplegma* Herdman, 1886 새공멍게 속

17. *Symplegma connectans* Tokioka, 1949 새공멍게

Material examined: P'ohang, Oct. 27, 1985 (S.J. Youn).

Genus 12. *Polyzoa* Lesson, 1830 폴리조아멍게 속**18. *Polyzoa pacifica*** Tokioka, 1951 태평양멍게

Material examined: Mip'o, Oct. 2, 1978 (S. Shin).

Genus 13. *Cnemidocarpa* Huntsman, 1913 등글멍게 속**19. *Cnemidocarpa areolata*** (Heller, 1878) 유두멍게

Material examined: Sögwip'o, Apr. 3, 1974 (B.J. Rho).

20. *Cnemidocarpa fertilis* (Hartmeyer, 1906) 퍼틸리스멍게 (Pl. 2c)

Material examined: Hodo, Jul. 19, 1984 (S. Shin); Shinsudo, Jul. 21, 1984 (B.J. Rho); Samchönp'o, Jul. 23, 1984 (J.H. Park).

21. *Cnemidocarpa macrogastra* (Oka, 1935) 긴위멍게 (Pl. 2d)

Material examined: Chungmu, Dec. 20, 1986 (KAIST); Pyönsan, Jul. 22, 1989 (J.W. Lee).

Genus 14. *Dendrodoa* Macleay, 1824 가지멍게 속**22. *Dendrodoa aggregata*** (Rathke, 1806) 가지멍게 (Pl. 2a-b)

Material examined: Tongbaekto, Apr. 26, 1975 (J.I. Song); Chisep'o, Jul. 9, 1977 (B.J. Rho); Mip'o, Oct. 2, 1978 (S. Shin); Mip'o, Jun. 22, 1985 (B.J. Rho).

Genus 15. *Styela* Fleming, 1822 미더덕 속**23. *Styela clava clava*** Hartmeyer, 1881 미더덕 (Pl. 3a)

Material examined: Naedo, Jul. 8, 1977 (B.J. Rho); Chisep'o, Jul. 9, 1977 (B.J. Rho); Hŭskando, Jul. 5, 1978 (J.H. Park); Tolsando, Jul. 10, 1982 (S. Shin); Taech'ön, Jul. 2, 1984 (J.H. Park); Shinsudo, Jul. 21, 1984 (B.J. Rho); Samchönp'o, Jul. 23, 1984 (B.J. Rho); Sodol, May 26, 1985 (J.I. Song); P'ohang, Oct. 27, 1985 (S.Y. Youn); Chungmu, Sept. 25, 1986 (KAIST); Chungmu, Oct. 8, 1986 (KAIST); Chakyakto, Oct. 24, 1987 (H.J. Hwang); Pyönsan, Jul. 22, 1989 (J.W. Lee); Chakyakto, Sept. 31, 1989 (J.W. Lee).

24. *Styela clava symmetrica* Tokioka, 1959 상칭미더덕 (Pl. 3b)

Material examined: Hodo, Jul. 19, 1984 (S. Shin).

25. *Styela longipedata* Tokioka, 1953 긴자루미더덕 (Pl. 3c)

Material examined: Chumunjin, May 3, 1987 (B.J. Rho).

26. **Styela plicata* (Lesueur, 1823) 주름미더덕 (신칭) (Fig. 4, Pl. 4a-b)

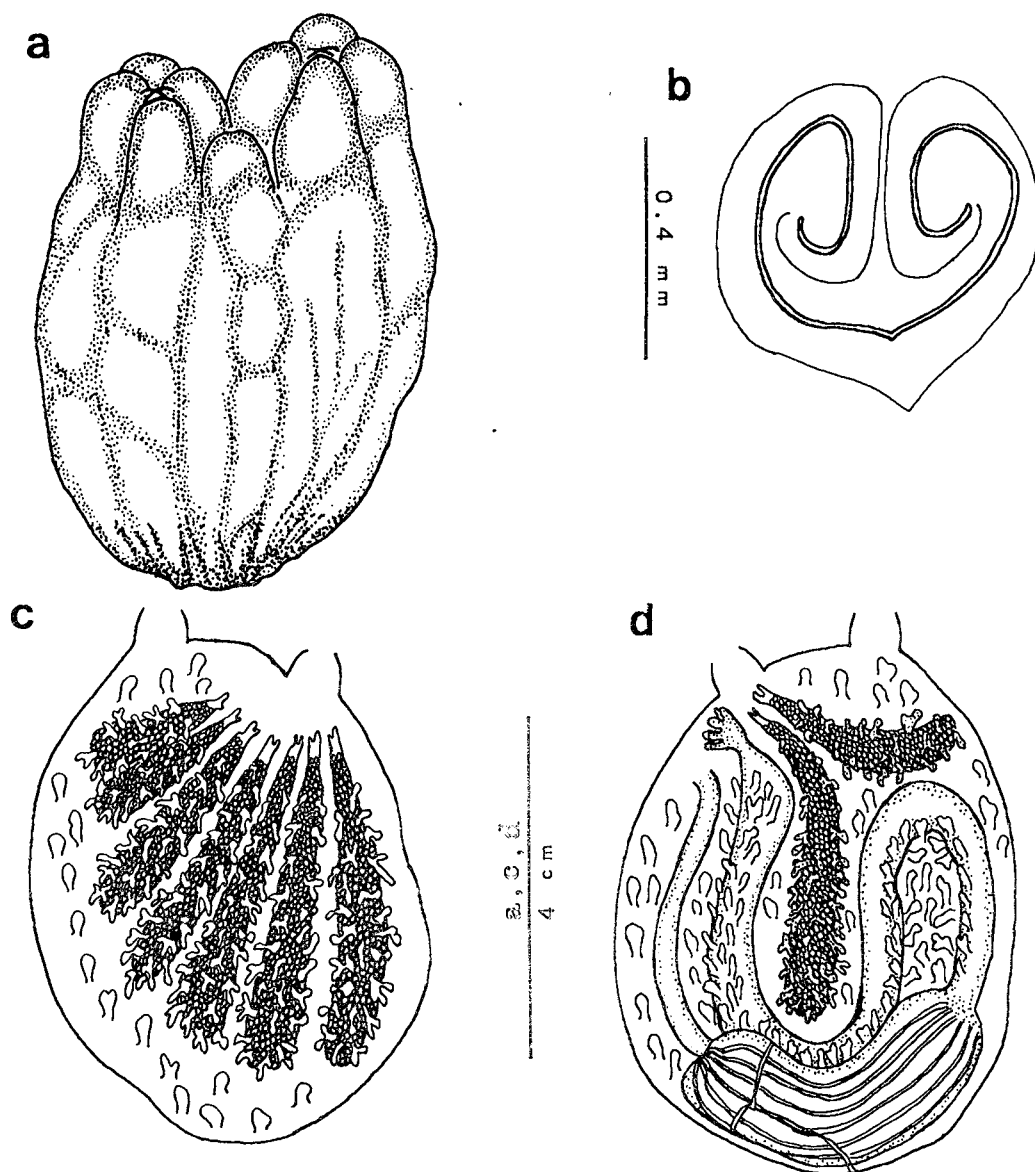


Fig. 4. *Styela plicata* (Lesueur, 1823). a, Animal from right side; b, Ciliated groove; c, Right half of mantle body, from inside; d, Left half of mantle body, from inside.

Styela plicata Traustedt, 1883 (pp.123-124, pl. 5, fig. 6, pl. 6 fig. 16); Huntsman, 1912 (p. 149); 1913 (pp. 489-497, fig. 13); Van Name, 1912 (pp. 435-440, figs. 102-105); 1930 (pp. 492-495, figs. 58-59); 1945 (pp. 295-298, pl. 12, figs. 1-3, text-figs. 192-194); Michaelsen, 1918 (p. 36); Harant, 1927a (p. 243); 1927b (p.7); Harant and Vernieres, 1933 (p. 31, fig. 46); Kott, 1972b (p. 185); 1972c (pp. 239-240); 1972d (p. 254); 1985 (pp. 116-118, figs. 50a, 51, pl. 2h); Kott & Goodbody, 1980 (p. 537); Tokioka, 1953 (pp.267-269, pl. 63, figs. 1-4); 1960b (pp. 212-213, pl. 28, figs. 21-22); Tokioka & Nishikawa, 1975 (p. 338); Oka, 1935 (pp. 447-448); Peres, 1951 (p. 1065).

Tethyum plicatum: Hartmeyer, 1909 (pp. 1359, 1630); Van Name, 1912 (pp. 569-571, fig. 36, pl. 62, figs. 104-105, pl. 63, fig. 108, pl. 68, fig. 136).

Styela gyrosa: Herdman, 1882 (p. 155).

Styela pinguis: Herdman, 1899 (p. 40).

Material examined: Pusan, May 26, 1981 (J.I. Song and S.J. Yoon); Samchŏnp'o, Dec. 27, 1986 (J.I. Song); Chungmu, Jun. 21, 1987 (KAIST).

Description: Specimens elliptical, 20-50mm in length and 20-30mm in greatest dorsoventral diameter, attached on hard bottom or shell of oyster. Both siphons four-lobed, very short, closed by each other, or atrial siphon situated at a little lower part of dorsal side. Test pale yellow in color, wrinkled at upper part and rounded ridges toward siphons, and smooth at lower part. But specimens from Pusan smooth, not wrinkled. Scales leaflets, flattened arranged in siphon lining. Endocarps found at inner surface on both sides. Tentacles alternately arranged, 35-40 in number according to size of individuals, and 25 in number at small one. Ciliated groove U-shaped slit and inrolled at both end branchial sac with four defined folds by wide flat intervals.

Inner longitudinal vessels as follows:

50mm long individual (from Samchŏnp'o):

Left dorsal line 3(28) 4(24) 3(22) 3(18) 3 endostyle

Right dorsal line 3(27) 4(23) 3(21) 3(18) 2 endostyle

27mm long individual (from Chungmu):

Left dorsal line 2(22) 3(18) 3(17) 3(13) 3 endostyle

Right dorsal line 2(24) 2(19) 3(17) 3(12) 3 endostyle

Three thinner vessels between thick transverse vessels ordered from thin one to thick one. Meshes in inter spaces between folds contain from seven to nine (mostly eight) stigmata. And thin transverse vessel crossed at middle part of stigmata. Oesophagus very long, stomach more elongate, and its walls with 27-38 longitudinal folds. Intestinal loop deeply curved with numerous endocarps on its wall. Anus 10-11 lobed, situated at base of atrial siphon. Gonads usually two or three in number on left side and 5-8 in number on right side placed with their necks converging towards base of atrial tube. Each gonads vary in size in same individual, consists of a central, elongate ovary along each side of small male glands. Vasa efferentia relatively short and male follicles close to, sometimes spreading over, mesial surface of ovary. On left side, anterior gonad extends straight across top of intestinal loop, and posterior gonad curved down into secondary intestinal loop. In color, ovary bright yellow, testis opaque white.

Remarks: This species is characterized in the whitish test with its rounded swellings, the siphonal scales, the deeply curved intestinal loop, crowded endocarps. The present specimens conforms to the descriptions of Tokioka (1953) but differs from the number of tentacles and the distribution of testis. And also, they are similar to the description of Kott (1985) in the number of stigmata, the place and number of gonad, and the shapes of intestinal loop, atrial scales and test.

Distribution: Korea (South Sea); Japan; Hongkong; the eastern coast of America; Australia; Atlantic Ocean; Mediterranean.

27. *Styela partita* (Stimpson, 1852) 두줄미더덕 (Pl. 4c)

Material examined: Tŏksan, Aug. 13, 1987 (B.J. Rho & J.W. Lee); Kŏmundo, Jul. 27, 1988 (B.J. Rho & J.E. Lee); Anmado, Aug. 19, 1989 (B.J. Choe); Sŏkmando, Aug. 20, 1989 (B.L. Choe).

28. *Styela esther* Hartmeyer, 1906 세줄미더덕 (Pl. 4d)

Material examined: Chungmu, Jun. 5, 1978 (B.J. Rho); Hodo, Jul 19, 1984 (J.E. Seo); Samchŏnp'o, Jul 23, 1984 (B.J. Rho); Mip'o, Jun. 22, 1985 (B.J. Rho).

Family 7. Pyuridae Hartmeyer, 1908 멍게 과

Genus 16. *Pyura* Molina, 1782 멍게 속

29. *Pyura vittata* (Stimpson, 1852) 끈멍게 (Pl. 5a)

Material examined: Yömi, Aug. 6, 1974 (B.J. Rho); Chungmu, Jun. 5, 1978 (B.J. Rho); To-dong, Oct. 26, 1978 (B.J. Rho); Wando, Jul. 24, 1981 (J.I. Song); Sangju, Aug. 7, 1983 (J.I. Song); Sodol, May. 26, 1985 (J.I. Song); Kūmodo, Jul. 31, 1988 (J.E. Lee).

30. *Pyura sanderi* (Traustedt & Weltner, 1894) 매 끈이멍게 (Pl. 5b)

Material examined: Shinsudo, Jul. 21, 1984; Chungmu, Jan. 21, 1987 (KAIST); Yundoldo, Jul. 19, 1989 (J.I. Song).

31. *Pyura squamata* Hartmeyer, 1911 네모가죽멍게 (Pl. 5c)

Material examined: Chungmu, Jun. 5, 1978 (B.J. Rho).

Genus 17. *Herdmania* Lahille, 1887 헬드만멍게 속

32. *Herdmania mirabilis* (von Drasche, 1884) 벼개멍게

Material examined: Mijori, Jul. 31, 1980 (J.I. Song).

Remarks: The present species differs from *Herdmania monus monus* (Pl. 9a) and *Herdmania monus siphonalis* (pl. 9b) in the oval bodies embedded in siphonal lining.

Genus 18. *Microcosmus* Heller, 1878 우주멍게 속

33. *Microcosmus multitentaculatus* Tokioka, 1952 우주멍게 (Pl. 5d)

Material examined: Mip'o, Jun. 22, 1985 (B.J. Rho).

Genus 19. *Boltenia* Savigny, 1816 침멍게 속

34. *Boltenia echinata echinata* (Linnaeus, 1767) 침멍게 (Pl. 6a-b)

Material examined: Taejin, Jun. 19, 1988 (J.E. Lee).

Remarks: The present species differs from *Boltenia echinata iburi* in the siphonal scales (Pl. 6c-d).

Genus 20. *Halocynthia* Verrill, 1879 우렁쟁이 속

35. *Halocynthia cactus* (Oka, 1932) 선인장멍게 (Pl. 7c-d)

Material examined: To-dong, Oct. 26, 1978 (S.I. Choe).

36. *Halocynthia roretzi* (von Drasche, 1884) 멍게 (우렁쟁이) (Pl. 8c)

Material examined: Samchönp'o, Jul. 23, 1984 (B.J. Rho); Chumunjin, May. 3, 1987 (J.W. Lee); Kündök, Aug. 13, 1987 (B.J. Rho & J.W. Lee); Yundoldo, Jul. 19, 1987 (J.I. Song).

37. *Halocynthia hilgendorfi ritteri* (Oka, 1906) 리테르개멍게 (Pl. 8a-b)

Material examined: Yundoldo, Jul. 19, 1989 (J.I. Song).

38. *Halocynthia hilgendorfi igaboja* (Oka, 1906) 이가보야개멍게 (Pl. 7a-b)

Material examined: Hodo, Jul. 19, 1984 (J.H. Park); Sodol, May 26, 1985 (S.J. Youn); P'ohang, Oct. 27, 1985 (S.J. Youn).

39. *Halocynthia aurantium* (Pallas, 1787) 붉은멍게 (Pl. 8d)

Material examined: Töksan, Aug. 13, 1987 (B.J. Rho).

Family 8. Molgulidae Lacaze-Duthiers, 1877 가죽빛멍게 과

Genus 21. *Molgula* Forbes, 1848 가죽빛멍게 속

40. **Molgula calvata* Sluiter, 1904 미끈가죽빛멍게 (신칭) (Fig. 5, Pl. 9c-d)

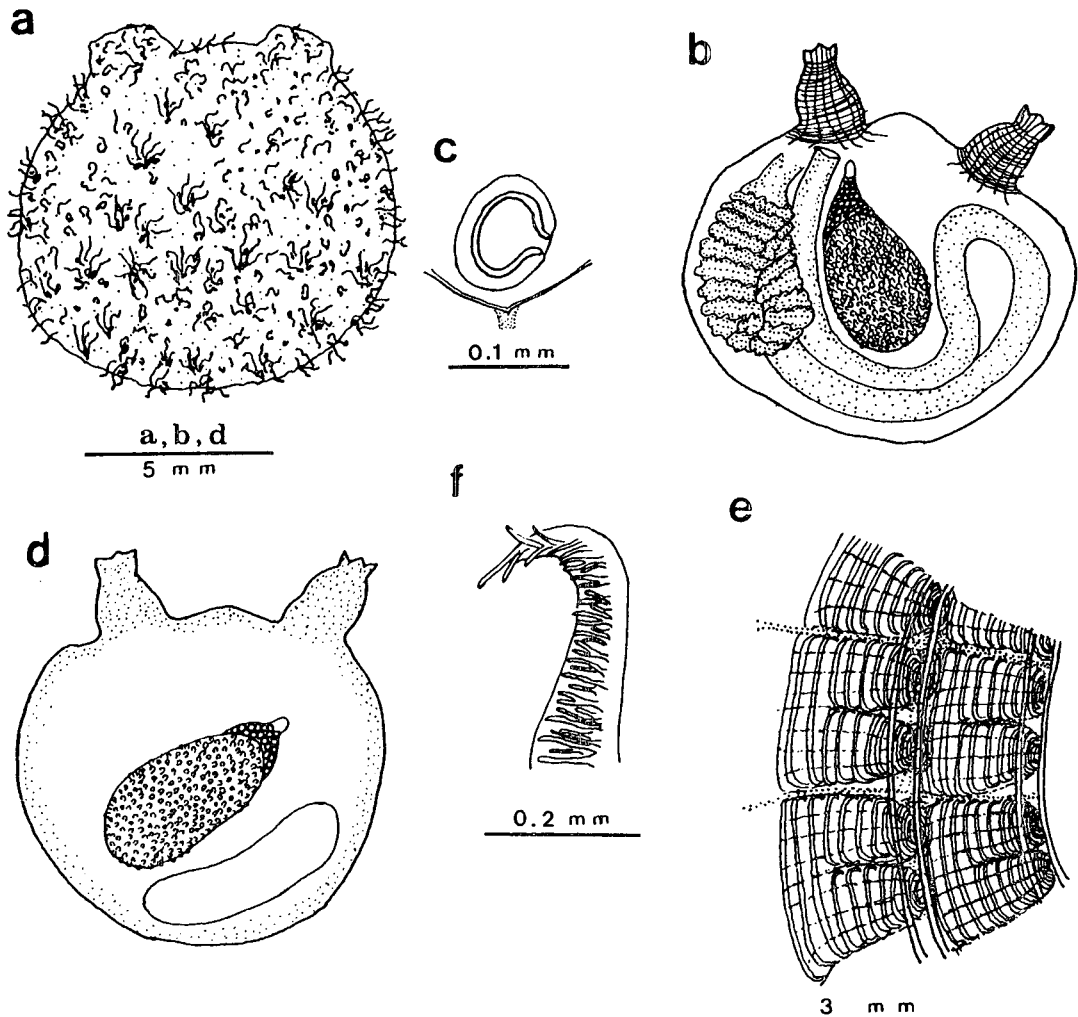


Fig. 5. *Molgula calvata* Sluiter, 1904. a, Animal from right side; b, Mantle body from left side; c, Ciliated groove; d, Mantle body from right side; e, Part of branchial sac (infundibula); f, Tentacle with branching.

Molgula calvata Sluiter, 1904 (p. 116); Kott, 1964 (pp. 144); 1985 (pp. 369-372, figs. 183a, 184); Miller, 1975 (pp. 322-323, fig. 101)

Material examined: Hodo, Jul. 19, 1984 (J.H. Park); Samchŏnp'o, Jul. 27, 1986 (J.I. Song).

Description: Individuals rounded, 10-20mm in height. Test thin, transparent, covered with long, fine, hair-like fibers, partly adhered with other materials. Both four-lobed siphons situated close by each other, produced into small, pointed processes at borders of them. Body wall delicate, transparent, reddish brown in color. Tentacles 12-15 in number, alternately arranged with primary and secondary branching. Ciliated groove C-shaped slit. Branchial sac 7 folds, showing 2 stigmata coiling together in each infundibulum. Two internal longitudinal vessels extend over each row of infundibula. Oesophagus very short. Intestinal loop turned over to almost from a circle with its oesophageal end. Elongate, broad liver pouches set in oblique rows on wide pyloric region of gut. Anus smooth, opened at base of atrial siphon. Gonads one per each mantle body, consist of a long, cylindrical ovary and long, branched testis follicles which encroached on surface of ovary. A left gonad fits into deep curve of intestinal loop, its oviducal opening near anal opening. A right gonad parallel to a long, relatively narrow kidney.

Distribution: Korea (South Sea); Australia (Western Coast, Queensland, New South Wales); Indonesia; Philippines.

ABSTRACT

This study on the systematic study of ascidians from Korea was based on the materials collected at 41 localities from July 1969 to September 1989. 40 species, eight families, three suborders in two orders were identified. Of these four species were new records for Korean waters: *Polyclinum planum*, *Didemnum candidum*, *Styela plicata*, and *Molgula calvata*. They were described with illustrations, and the species which were characterized by spicules and siphonal armatures were added with plate figures.

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EXPLANATION OF PLATES 1-9

Plate 1 (Scales: 0.01mm)

- a. *Didemnum candidum*, spicules
- b. *Trididemnum savignii*, spicules
- c-d. *Leptoclinides madara*, spicules

Plate 2. (Scales: a,b, 0.01mm; c,d, 0.1mm)

- a-b. *Dendrodoa aggregata*-oval bodies embedded in siphonal lining
- c. *Cnemidocarpa fertilis*, siphonal lining
- d. *Cnemidocarpa macrogastra*, siphonal lining

Plate 3 (Scales: 0.01mm)

- a. *Styela clava clava*, siphonal scales
- b. *Styela clava symmetrica*, siphonal scales
- c. *Styela longipedata*, siphonal scales
- d. *Styela atrantica*, siphonal scales

Plate 4 (Scales: 0.01mm)

- a. *Styela plicata*, siphonal scales system
- b. *Styela partita*, siphonal scales
- c. *Styela partita*, siphonal scales
- d. *styela ester*, siphonal lining

Plate 5 (Scales: a,b, 0.1mm; c, 0.01mm; d, 0.02mm)

- a. *Pyura vittata*, siphonal spines
- b. *Pyura sanderi*, siphonal spines
- c. *Pyura squamata*, Siphonal scales
- d. *Microcosmus multitentaculatus*, siphonal spines

Plate 6 (Scales: 0.01mm)

- a. *Boltenia echinata echinata*, siphonal scales system
- b. *Boltenia echinata echinata*, siphonal scales
- c. *Boltenia echinata iburi*, siphonal scales system
- d. *Boltenia echinata iburi*, siphonal scales

Plate 7 (Scales: a-c, 0.1mm; d, 0.01mm)

- a. *Halocynthia hilgendorfi igaboja*, siphonal spines and scales (sc, scales; sp, spines)
- b. *Halocynthia hilgendorfi igaboja*, siphonal scales
- c. *Halocynthia cactus*, siphonal spines and scales
- d. *Halocynthia cactus*, siphonal scales

Plate 8 (Scales: a,c,d, 0.1mm; b, 0.01mm)

- a. *Halocynthia hilgendorfi ritteri*, siphonal spines and scales (sc, scales; sp, spines)
- b. *Halocynthia hilgendorfi ritteri*, siphonal scales
- c. *Halocynthia roretzi*, siphonal spines
- d. *Halocynthia aurantium*, siphonal spines are branched

Plate 9 (Scales: 0.1mm)

- a. *Herdmania momus momus*-oval bodies embedded in siphonal lining
- b. *Herdmania momus siphonalis*-oval bodies embedded in siphonal lining
- c-d. Portion of branchial sacs.
Molgula clavata showing 2 stigmata coiling together in each infundibulum (f, fold; st, stigmata)

PLATE 1

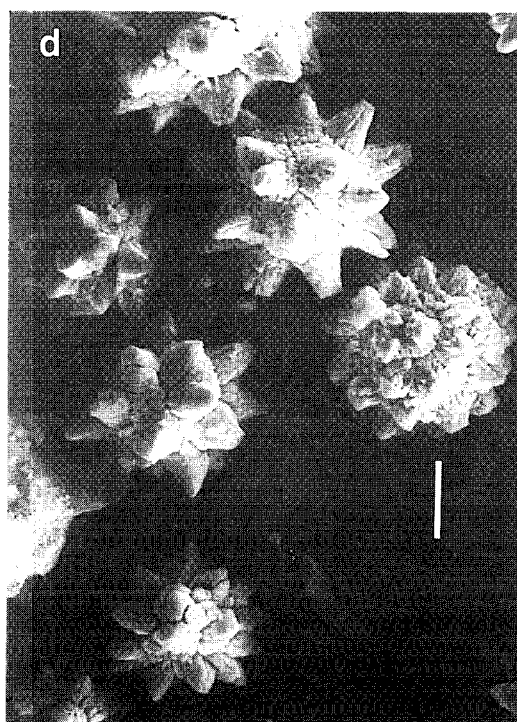
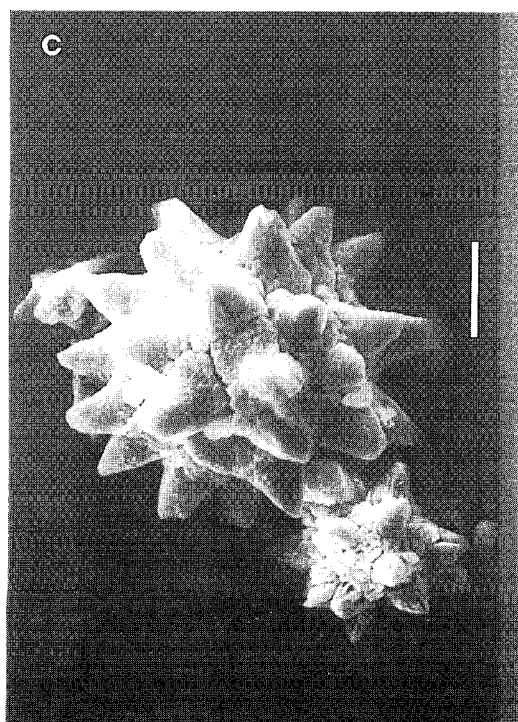
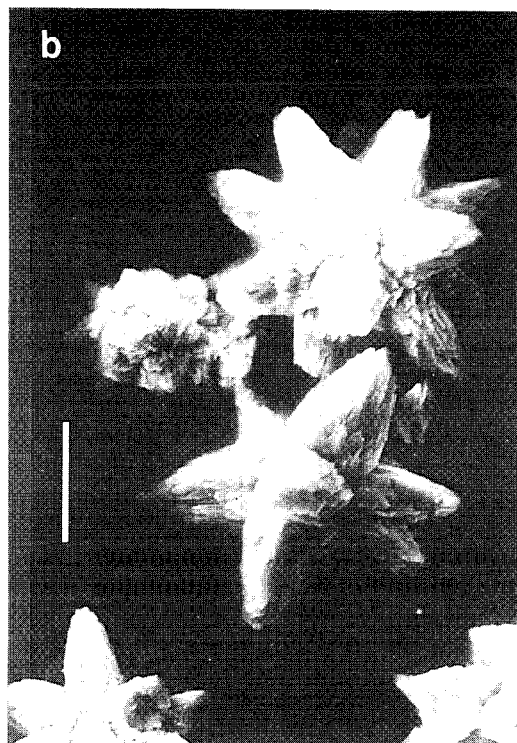
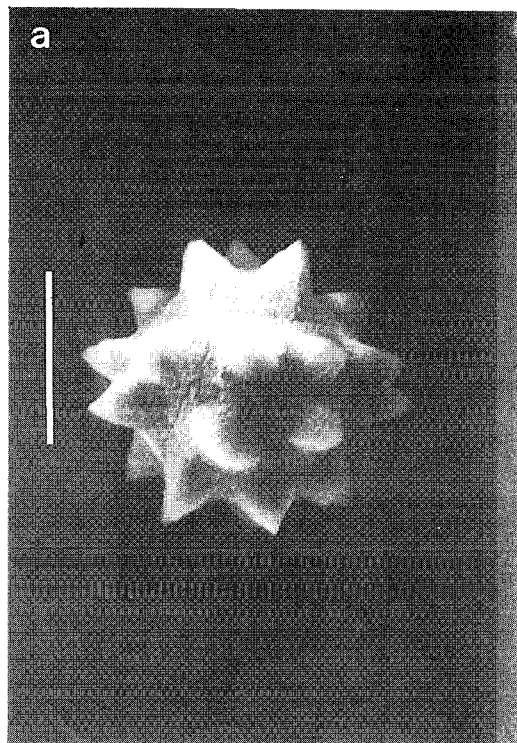


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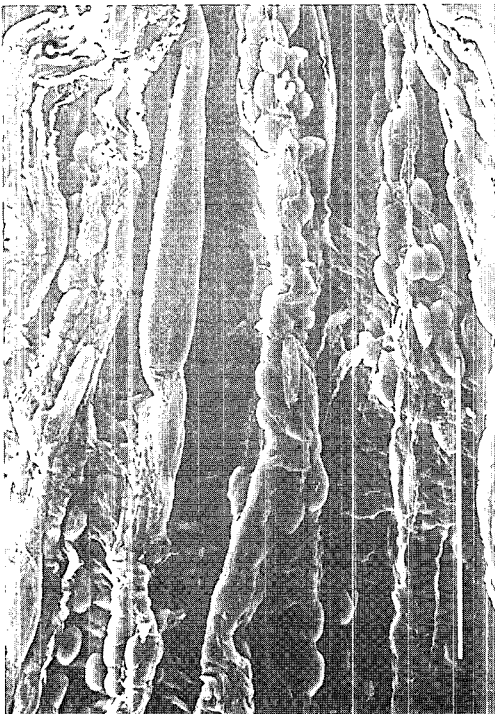
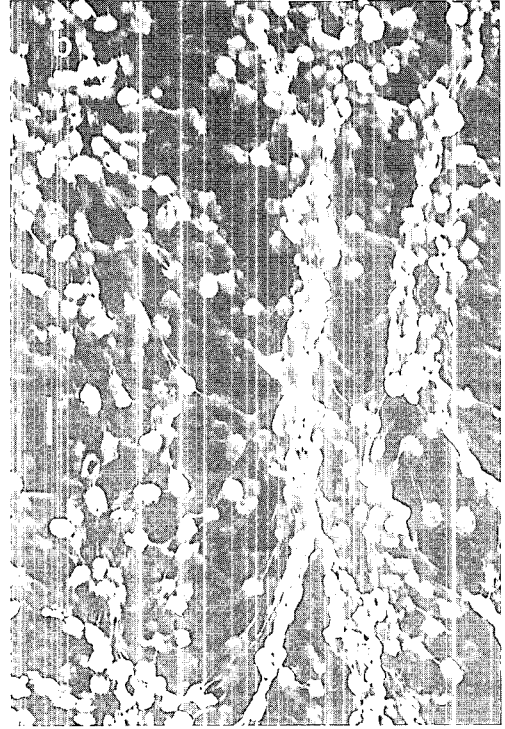
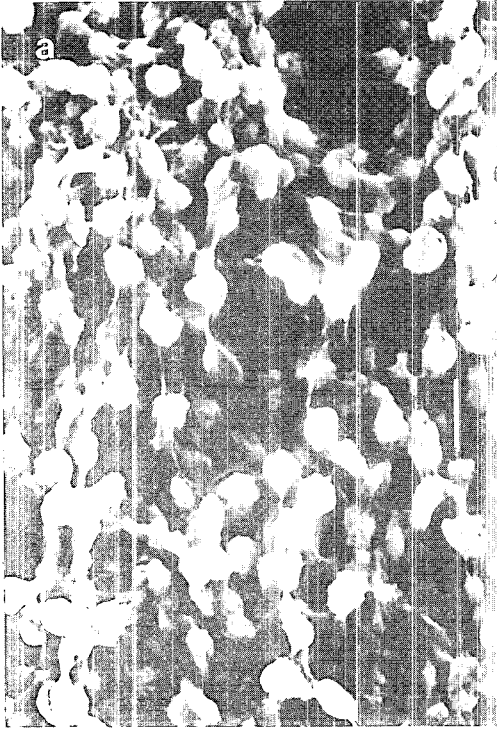


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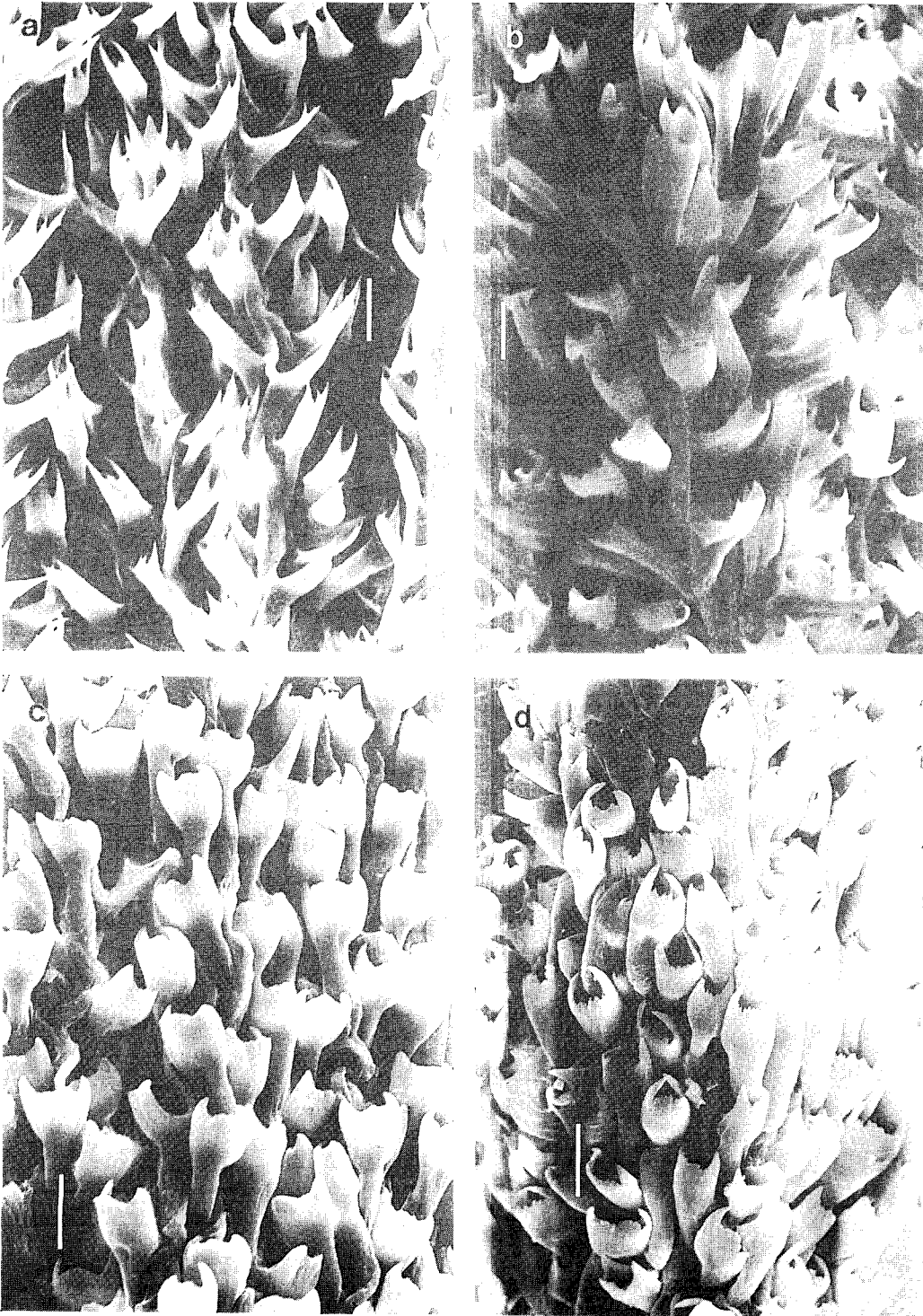


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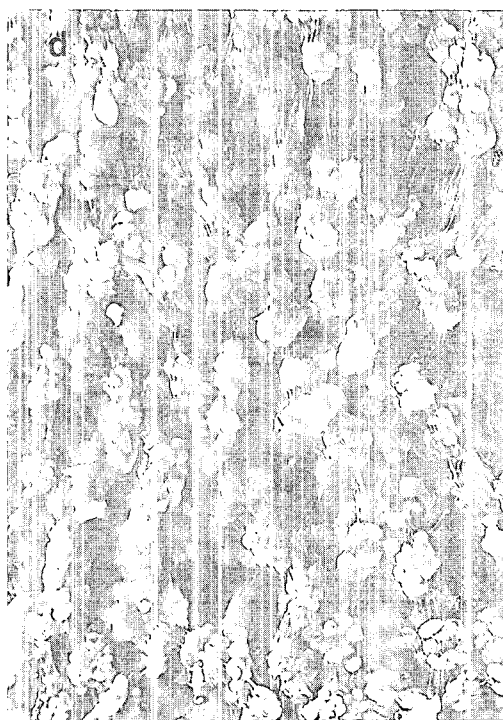
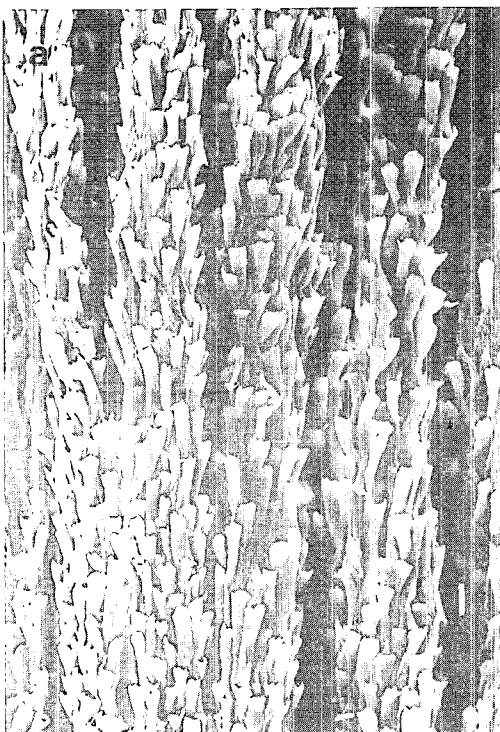


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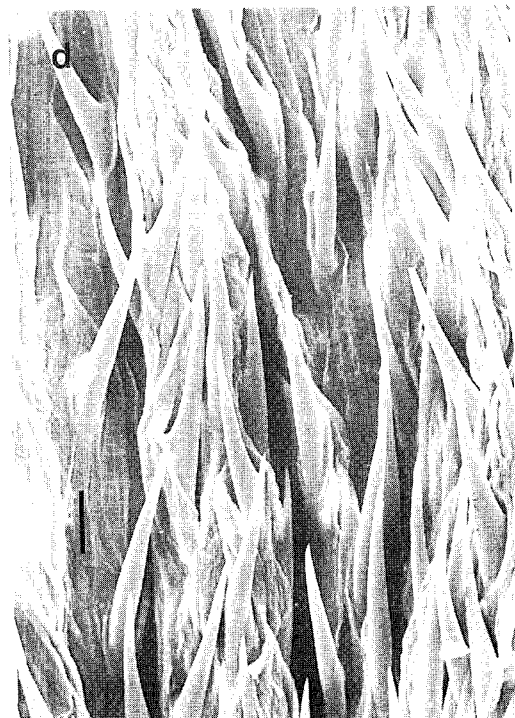
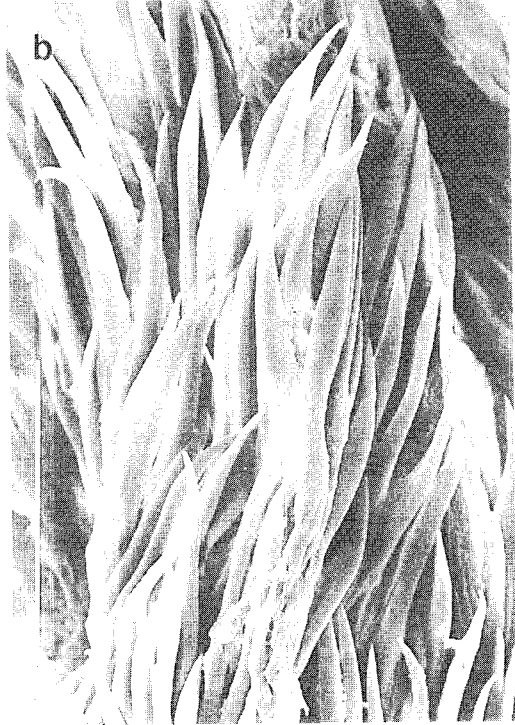
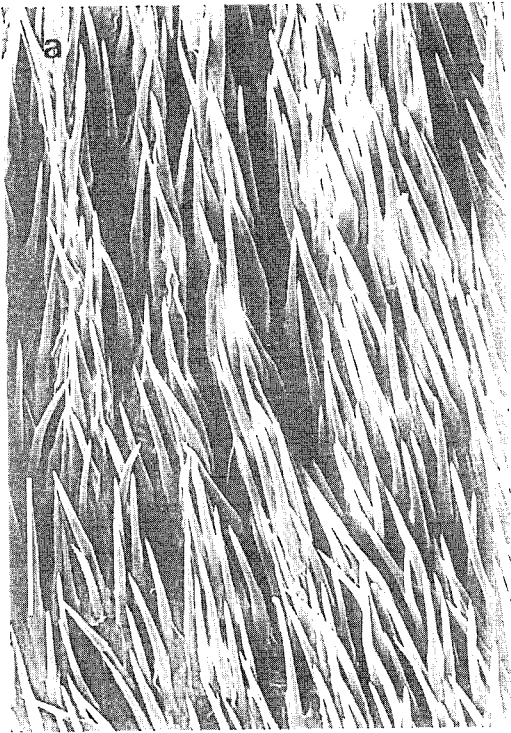


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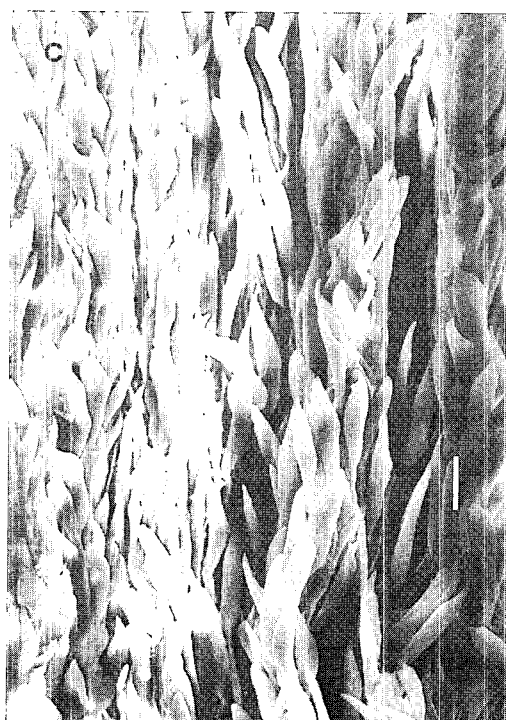
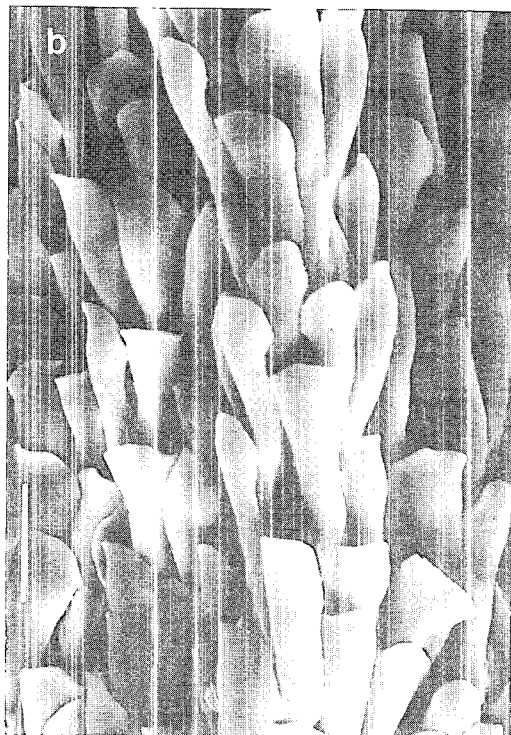
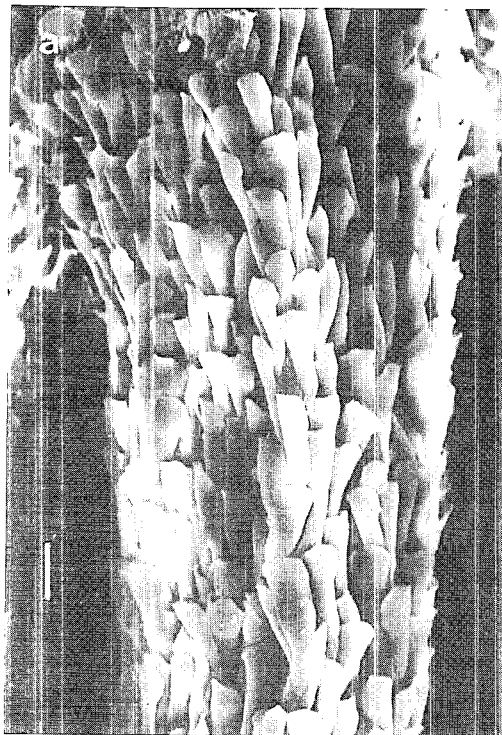


PLATE 7

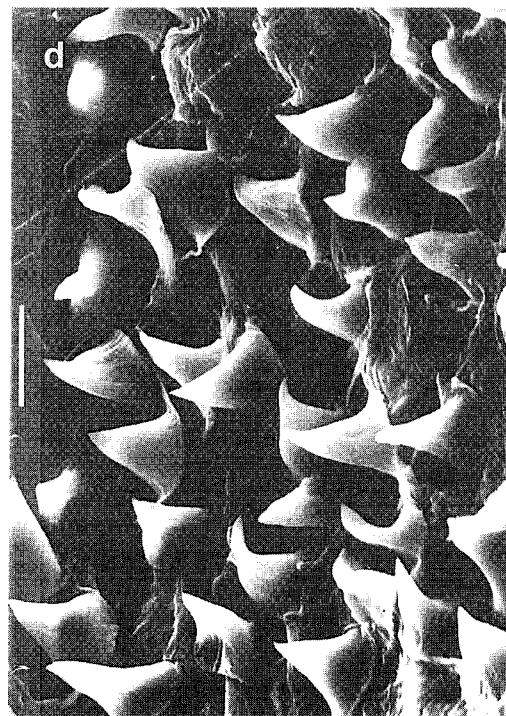
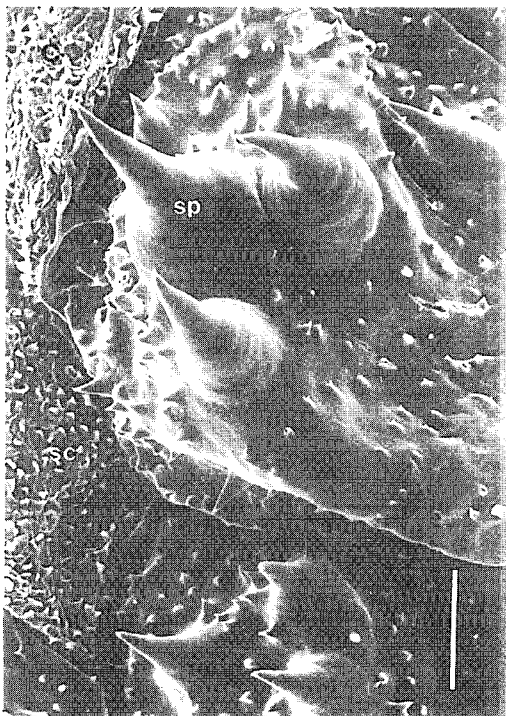
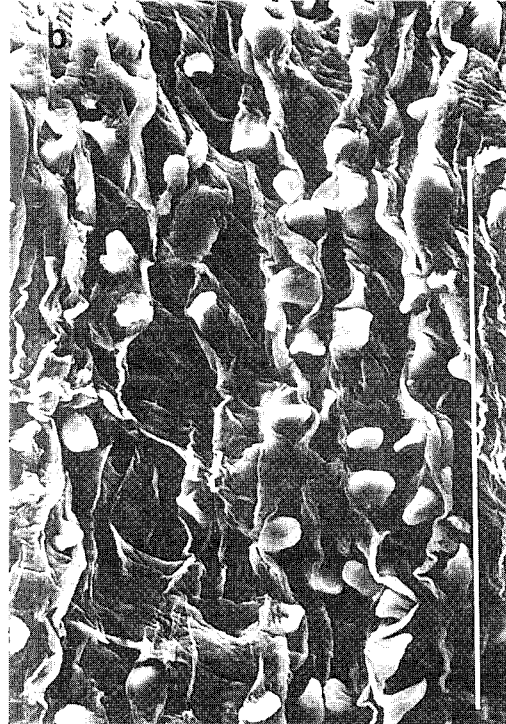
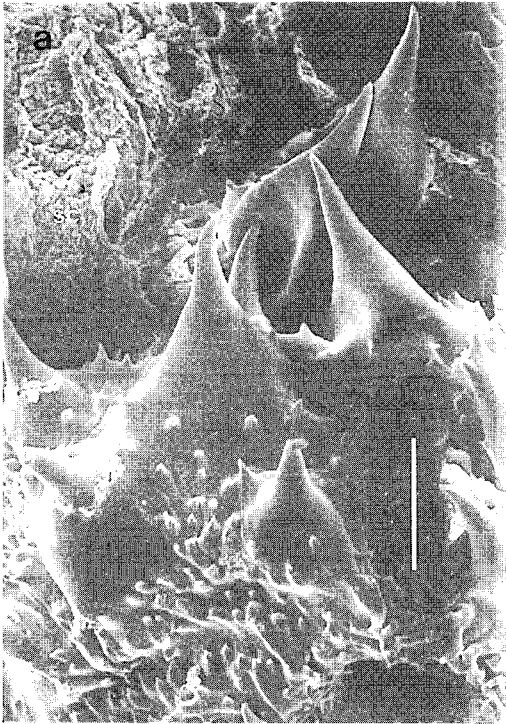


PLATE 8

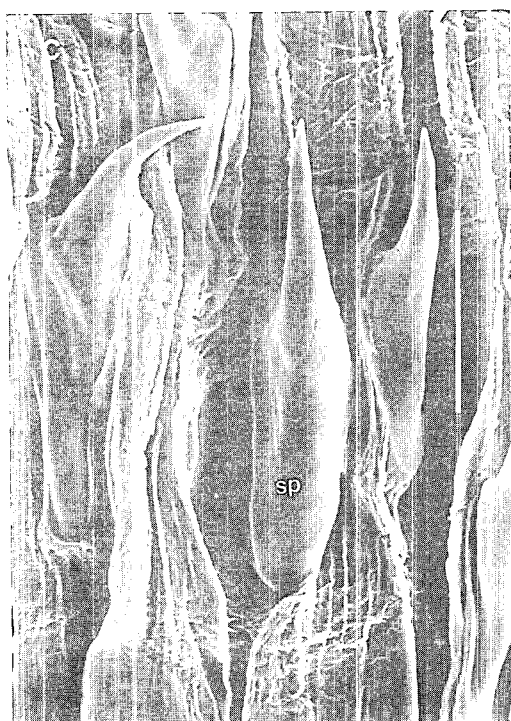


PLATE 9

